

**Heavy Off-Road Construction Equipment
Emission Reduction Pilot Project
Progress Report**

**California Department of Transportation
Division of Construction
Office of Construction Practices**

May 20, 2003

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Background

The following is a progress report on the California Department of Transportation (Department) pilot program to reduce emissions from construction equipment by providing financial incentives for contractors to use low emissions off road construction vehicles. There are 21 projects in the pilot program ranging from project initiation to construction contract acceptance.

The resident engineer (RE) for each project was assigned the responsibility for monitoring the contractor's success in reducing emissions. If the contractor is determined to be successful in reducing emissions, the contractor may be paid up to the lesser amount of \$250,000 or 2% of the contract amount. A checklist for the emissions reduction requirements is enclosed (Attachment 1).

A total of 3 days of training was provided to the project staff on the 03-SAC-16 project as well as other resident engineers and field staff working around the Sacramento Metropolitan Air Quality Management District (AQMD). This training was provided as a part of a larger air quality improvement agreement between District three and the AQMD. This training consisted of technical air quality science, engineering properties of air quality monitoring, and visual opacity measurement techniques. Due to the geographic spread of projects and vastly different scheduling, similar training was not available for other projects included in the pilot program. However, a checklist was developed as an inspection and enforcement guide for field inspectors and resident engineers on these excluded projects. The headquarters construction division environmental specialist provides these engineers with additional technical support to resolve contract administration, special provision interpretation, and regulatory compliance issues. The resident engineer on the Sac 16 project has also fielded questions from other contract administrators across the state.

The driving forces behind implementation of the construction emission reduction pilot program include:

- The need to develop new approaches to improve air quality since much of California is a non-attainment area for State and Federal air standards.
- Diesel engines are a major, in some cases the overwhelming, contributor of NOx levels through engine emissions. In most ozone non-attainment areas (Figure 4), the most important "precursor" to ozone needing to be further reduced is nitrogen oxide (NOx) emissions.
- Because stationary sources of pollution (including stationary and portable diesel engines) are tightly controlled by national, statewide,

and local AQMD regulations and permit requirements, these devices were excluded from participation in this pilot project.

- On-road mobile sources, including diesel-powered vehicles are tightly controlled by national and statewide regulations. This equipment was excluded from the program.
- Off-road mobile sources such as diesel-powered construction equipment had few emission standards until the late 1990's. This type of unregulated construction equipment was the logical target for this pilot project. Most AQMDs consider these emission sources to be generally amenable to major improvements.

Definitions

Qualifying off-road heavy-duty diesel equipment for this program must be a self-propelled construction vehicle that complies with the following criteria:

- The vehicle must be powered by a California Air Resources Board certified off-road diesel engine. Certification shall be verified by a label attached to the engine in conformance to the requirements of California Code of Regulations, Title 13.
- The vehicle must use diesel fuel.
- The equipment must have a manufacturer's maximum gross weight rating of 2721.5 kg or more and power rating between 37.3 and 559.3 kilowatts.
- A transportation permit would be generally required to move this equipment over long highway distances due to length, height, width, or weight.

Objective

The purpose of the program is to determine the effectiveness a limited incentive payment would have on improving the emission performance of contractor off-road equipment fleets. In accordance with Caltrans' Goal IV "Demonstrate leadership and integrity in everything we do", the Construction Division's 2000 Action Plan included the objective to "reduce the impacts of construction activities on the environment". The work plan action item to meet this goal is the emission reduction pilot program.

Project Selection

Criteria for selecting projects for this pilot program are as follows:

- Projects should be located in non-attainment areas with a classification of serious or worse for the Federal 1-hour ozone standard. Though these types of projects are preferred, any project located in any Federal ozone non-attainment area may be considered.
- Projects should be valued over \$5,000,000.
- All projects advertised in 2000-02 fiscal years are eligible for the pilot program.
- Projects must require substantial earthwork, paving, or grinding.
- The program must have minimal impact on project budget since the incentive will cost \$250,000 or 2% of the base project cost (before change orders or adjustments), whichever is less.

A number of challenges were encountered while attempting to implement this pilot program:

- Since capital project funds were usually fully committed and additional funding was not provided as a part of this pilot program, it was difficult to recruit projects to participate.
- Identifying projects using the ready to list (RTL) roster was difficult. The RTL roster contained few projects (less than 50%) that were actually close to advertising or award.
- When provided the opportunity to bid and participate in the program, only a few of the 20 contractors expressed any real interest and many others remain undecided whether or not to participate in this program (Figure 3).
- After selection, some projects excluded the incentive from the contract special provisions. Staff that was directed to include the specification in the contracts often overlooked projects on the list. This happened despite the district's assurances that all agreed upon contracts would include the specification.

Figure 1: Pilot Projects Still in PS&E

| No | Dist-Co-Rte | EA | Proj Mgr | PS&E | |
|----|--------------|--------|----------|---------|---------|
| | | | | Appt | Delayed |
| 1 | 07-LA-90 | 1693U1 | Ghamidi | 6/12/01 | Yes |
| 2 | 12-Ora,LA-60 | 079201 | Vpham | 2/13/02 | Yes |
| 3 | 03-Pla-80 | 0A6001 | Kdreher | 4/4/02 | Yes |

Figure 2: Awarded Pilot Project List

| No | Dist-Co-Rte | % | CC&A | EA | Resident Engineer |
|----|----------------|------|----------|--------|----------------------|
| | | Comp | Date | | |
| 1 | 03-Sac-16 | 100 | 5/13/02 | 371104 | Pete Spector |
| 2 | 03-Yub-70 | 0 | TBD | 376104 | TBD |
| 3 | 04-SCI,Ala-880 | 66 | 1/29/04 | 285524 | Mohammad Sulieman |
| 4 | 06-Ker-202 | 100 | 8/30/02 | 407704 | Jack Collins |
| 5 | 11-SD-94 | 67 | 1/23/03 | 078004 | Constantine Kontaxis |
| 6 | 03-Sac-80 | 45 | 8/4/04 | 3546U4 | Meshack Okpala |
| 7 | 11-Imp-111 | 89 | 6/3/03 | 199344 | Jitendra Goyal |
| 8 | 07-LA-405 | 89 | 5/15/03 | 191304 | Miguel Rodriguez |
| 9 | 11-SD-05 | 56 | 10/6/03 | 185944 | Gary Levine |
| 10 | 12-Ora-55 | 100 | 7/24/02 | 095624 | Arsalan Naderi |
| 11 | 07-LA-710 | 57 | 12/22/03 | 201304 | Reza Jahromi |
| 12 | 07-LA-10 | 40 | 3/7/03 | 1069U4 | Gamal Tawfik |
| 13 | 12-Ora-22,5 | 100 | 8/7/02 | 0850U4 | Robert Zordani |
| 14 | 11-SD-15 | 92 | 5/10/04 | 073404 | Pedro Aguilar |
| 15 | 04-Sol-37 | 41 | 10/29/04 | 0T1414 | Carl Butters |
| 16 | 04-SF-80 | 86 | 3/7/03 | 0435V4 | Marcus Washington |
| 17 | 04-SM-82 | 100 | 4/17/02 | 174904 | Khaled Elshaer |
| 18 | 07-Ven-101 | 30 | 8/9/04 | 104954 | George Malacalza |
| 19 | 11-Imp-98 | 100 | 3/7/03 | 1734U4 | Sandro Bermudez |
| 20 | 06-Fre-180 | 25 | 10/26/04 | 342424 | TBD |

Findings

Queries (Figure 3) were sent out to each pilot project resident engineer requesting a status report on the effectiveness of the emissions reduction contract specification. Responses were received from the resident engineers of the eighteen projects underway or completed. Of the 21 projects included in the pilot program, three were recently awarded and data is not available. The following findings are based on these resident engineer's responses:

- About 45% of eligible contractors were participating in the program.
- Of these participating contractors, 78% had submitted emission reduction plans.
- Resident Engineers had approved 86% of these contractor emission reduction plans.
- Progress reports were being submitted by contractors for all the approved plans. All resident engineers expended resources to actively administrate these specifications. The contractor plans were effective since resident engineers forecasted that 88% of the contractors would qualify for at least a portion of the incentive.
- Resident engineers generally understood the contract specifications and knew the incentive was capped at \$250,000 or 2% of the base project cost (before change orders, adjustments, etc.) whichever is less.
- Formulas used to calculate the incentive payment were difficult for many resident engineers to understand. Resident engineers often asked for assistance in defining and interpreting these parameters from their headquarters construction coordinator and the headquarters environmental specialist.
- Larger contractors that have newer equipment and the ability to rotate equipment between private and public contracts most often took advantage of the incentive.

The results of the queries are tabulated in Figure 3 below.

Figure 3: Questionnaire Response Summary

| Activity | Yes | No | Not Applicable | Comments |
|--|-----------|----|----------------|--------------------------|
| Is the Contractor Participating? | 8 | 10 | 2* | *2 projects just awarded |
| Has the Contractor Submitted a Plan? | 7 | 2 | 9 | |
| Have You Approved the Contractor's Plan? | 6 | 3 | 9 | |
| Has the Contractor Submitted Progress Reports? | 6 | 3 | 9 | |
| Does It Appear that the Contractor Will Achieve the Reduction? | 7 | 1 | 11 | |
| If the Project Is Complete or Near Completion, What Was the Dollar Amount of the Incentive Paid? | \$239,000 | | | 3 Projects |

Conclusions

Based on the findings above and experiences with implementing this pilot program:

- Some progress in reducing emissions has been achieved on three projects.
- Too few projects have yielded results as yet to determine the overall success of the emissions reduction pilot project. However, it is clear that this success will be limited since few of the contractors have met program requirements to receive the incentive.
- Future progress in reducing emissions by expanding this incentive program does not appear promising since most of the contractors chose not to participate in the program. The specific reasons are likely to be complex. The working hypothesis to explain this low participation is that the monetary incentive may be too small relative to qualifying equipment rental, lease, or purchase costs; and therefore may be insufficient to attract wide scale contractor participation.
- It will be several years before all results are quantified since some of the projects have just been awarded and a few are still in PS&E development.
- Thus far, contractors on three projects have received approximately \$239,000 in incentive payments. This falls far short of the potential \$5 million that is available to the industry.
- This program will require dedicated funding to be successful.

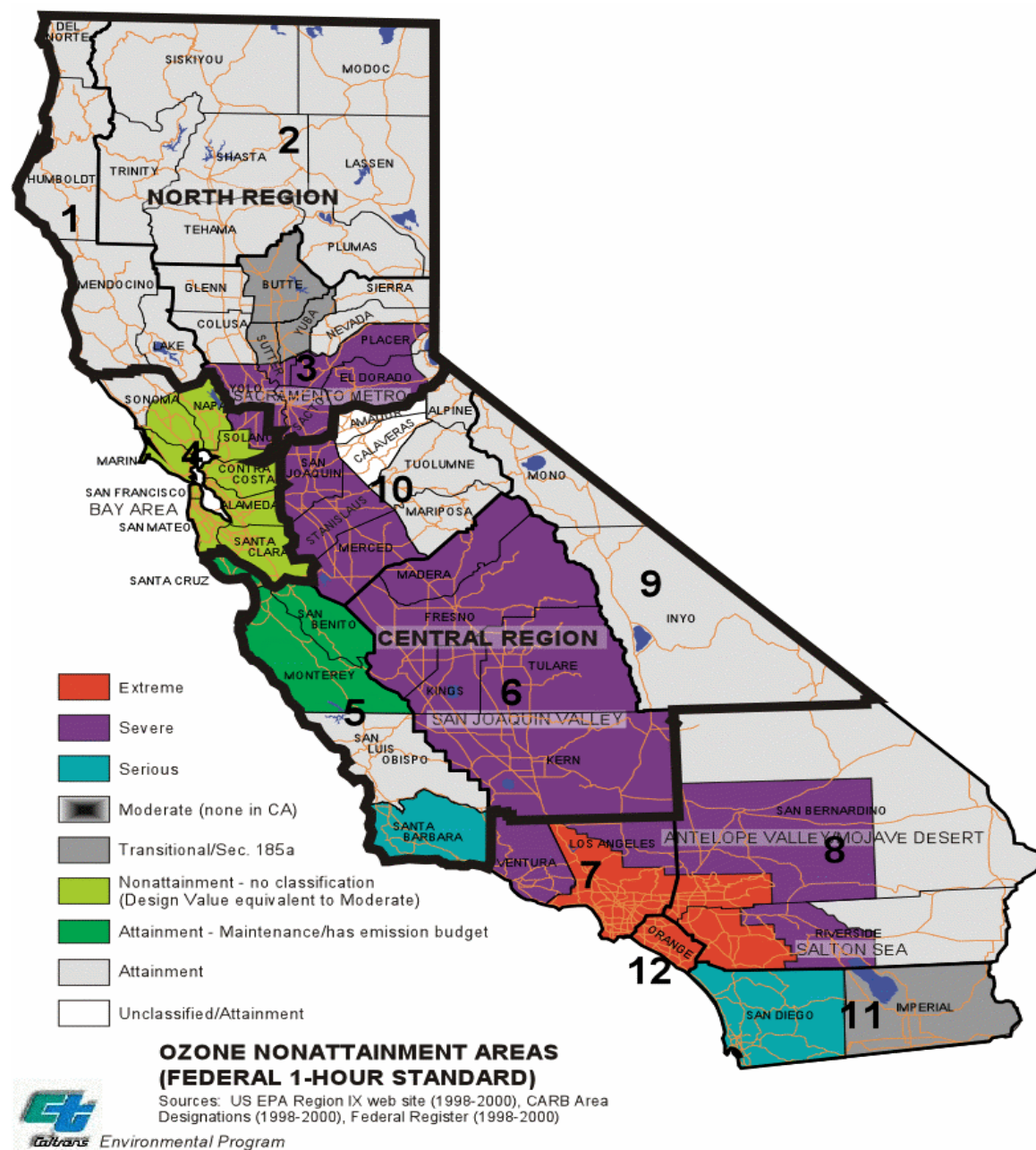
Recommendations

Building on the conclusions listed above, the following actions are recommended:

- Continue to monitor those pilot projects where the contractor has elected to participate in order to determine success in meeting diesel emissions reduction.
- The number of pilot projects should not be increased since a representative sample was achieved, the pilot is in process, and current budget constraints make it difficult to recruit new projects.
- Consider an alternative to reducing diesel emissions on Caltrans projects alone. The Air Resources Board has an existing diesel emissions program (Attachment 2) that is successfully converting and upgrading diesel equipment. Contributing funds toward this program may be more effective than this pilot program. Perhaps a

system of issuing “credits” for air quality improvements could be negotiated with the AQMDs to facilitate those projects in air quality non-attainment areas.

Figure 4: Ozone Non-Attainment Areas



ATTACHMENT 1: CHECKLIST FOR EMISSIONS REDUCTION REQUIREMENTS

STEP-1 **REVIEW CURRENT CONTRACT REQUIREMENTS FOR EMISSIONS REDUCTION:** Resident Engineers should conduct a cursory review of the existing contract to assure that any air quality requirements beyond those required for participation in the incentive program are incorporated and or addressed. Existing contract requirements may be spelled out in the contract or in a permit required by the Air Quality Management District. Requirements. Any discrepancies identified will need to be resolved.

STEP 2 The resident engineer shall review the contract requirements for participating in the incentive program against the criteria provided in the checklist provided below. The resident engineer shall provide the contractor a copy of the completed checklist. The contractor shall then be required to make any changes to the emissions proposal to achieve the reduction.

Each of the checklist items listed below is a requirement to achieve the emissions reduction incentive.

- Yes ☐ No ☐** 1. Have supplemental funds for the emissions reduction incentive program been included (lesser amount of 2% of the contract or \$250,000)? (Note: Inclusion in this pilot program is justification for exceeding the limits in the PS&E Guide)
- Yes ☐ No ☐** 2.a. Has the Contractor selected Method 1 to provide for a reduction in NOx emissions? (Method 1 provides that more than 20% of the off-road heavy duty diesel equipment used during construction of the project shall be controlled equipment based on fuel consumption)
- Yes ☐ No ☐** 2.b. Has the Contractor submitted an Excel spreadsheet for tracking equipment and fuel use?
- Yes ☐ No ☐** 3. Has the Contractor selected Method 2 to provide for a reduction in NOx emissions? (Method 2 provides that the off-road heavy diesel equipment used on the project produces NOx emissions less than that produced by a fleet utilizing 20% controlled equipment.)
- Yes ☐ No ☐** 3.a. Did the Contractor shall describe in the plan how the emissions reduction will be determined (i.e., submit an Excel spreadsheet for tracking information)?
- Yes ☐ No ☐** 3.b. Did you review and approve, or return the plan to the Contractor for additional information within 10 days of receiving the plan?
- Yes ☐ No ☐** 3.c. Did the Contractor re-submit the plan within 7 days after receiving your request for additional information? (With Your written approval, the Contractor may start work during the re-submittal period.)
- Yes ☐ No ☐** 4. Did the Contractor submit a Construction Equipment Emission Plan (CEEP) to you at least 10 days prior to starting work? (Note: Data sheets shall be maintained and submitted as specified herein if work begins before the CEEP has been approved)
- Yes ☐ No ☐** 5 Does the CEEP data sheets contain the information for all off-road, heavy-duty diesel

equipment? (Note: The data sheets are to be submitted to you biweekly and be signed by an authorized representative of the Contractor. The data sheets are to be maintained on a daily basis)

- Yes ☐ No ☐ 6.a. Equipment identifying number conforming to the provisions in Section 5-1.10, "Equipment and Plants," of the Standard Specifications
- Yes ☐ No ☐ 6.b. Equipment make and model
- Yes ☐ No ☐ 6.c. Engine type and year
- Yes ☐ No ☐ 6.d. Engine power rating
- Yes ☐ No ☐ 6.e. Engine modifications
- Yes ☐ No ☐ 6.f. Engine modifications
- Yes ☐ No ☐ 6.g. Hours of operation of equipment
- Yes ☐ No ☐ 6.h. Fuel usage
- Yes ☐ No ☐ 6.i. A signed statement containing the following language:

The undersigned,

Name

Date

Title

hereby certifies that the information provided herein is true and correct.
submitted as specified herein if work begins before the CEEP has been approved.

CEEP Review:

- Yes ☐ No ☐ 7. Did you review the CEEP and make an initial determination whether the Contractor will meet or exceed the 20 percent controlled equipment utilization?
- Yes ☐ No ☐ 8. If your initial determination concludes the Contractor will meet or exceed the 20 percent controlled equipment utilization or equivalent, did you release 50 percent of the maximum possible incentive? (Note, The calculation for the contract with the first progress payment after approval of the CEEP must conform to the provisions in Section 9-1.06, "Partial Payments," of the Standard Specifications)
- Yes ☐ No ☐ 9. At completion of the contract, did you evaluate the information collected in the data sheets submitted by the Contractor to make a final determination whether the Contractor has met or exceeded the 20 percent emissions reduction? (Note: Based on this evaluation, adjustments to the calculated incentive payment will be

made. The final incentive amount, less the initial payment made upon approval of the CEEP, will be paid upon completion of this final determination).

12

Yes ☐ No ☐

10. Based on the final determination of percent emission reduction, did you reduce any excess payment previously made for emission reduction incentive program to the Contractor from moneys due or to become due the Contractor.

ATTACHMENT 2

Carl Moyer Program

Release 01-12
**FOR
IMMEDIATE
RELEASE
April 26, 2001**

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SACRAMENTO – The California Environmental Protection Agency’s Air Resources Board (ARB) today approved a report to the state legislature on an incentive program that has reduced smog-forming and cancer-causing air emissions from diesel engines.

The Carl Moyer Memorial Air Quality Standards Attainment Program reduces oxides of nitrogen (NOx), which contribute to ozone, one of the most health-damaging components of smog, and also reduces cancer-causing particulate matter (PM).

“Carl Moyer projects reduce high diesel emissions in all communities,” said ARB Chairman Dr. Alan Lloyd. “I would like to see at least 50 percent of the Moyer projects go to benefit communities that are disproportionately impacted by air pollution,” he said.

The governor and legislature have approved \$98 million over the last three fiscal years to fund the Moyer Program. In addition, the 22 local air pollution control districts that administer the funding for ARB provide approximately \$40 million in matching funds.

Estimated emission reductions from the program’s first two years are about 2200 tons per year (TPY) of NOx and about 70 TPY of PM. When third-year projects are implemented, it is anticipated that annual NOx reductions will reach about 4400 TPY and PM emissions about 140 TPY.

The majority of Moyer Program funding has been spent to upgrade or replace diesel engines in city transit buses, school buses, trash trucks and agricultural irrigation pumps. Upgrades to diesel engines can include replacing existing engines with newer, cleaner models and converting to engines powered by alternative fuels or electricity.

The program’s emission reductions are achieved by funding the incremental cost of cleaning up diesel engine NOx and PM emissions below the levels called for by current standards, agreements or regulations.

As an example, under the Moyer program, a company purchasing a \$100,000 new truck that meets the state’s minimum NOx emission standards, can instead buy a \$125,000 new truck that beats the NOx standards by at least

30 percent. Moyer funding pays the additional \$25,000 for the cleaner truck. This framework is also used to determine other Moyer grants, including those for off-road and other equipment, large marine vessels, locomotives, forklifts and airport ground support equipment.

The program is named for the late Dr. Carl Moyer, a visionary scientist who worked to establish government incentive programs to defray the cost of reducing harmful air emissions. Since diesel engines frequently have a “life” of 20 or more years, the Moyer Program has been particularly effective in replacing some of the state’s oldest, highest polluting engines.

The Air Resources Board is a department of the California Environmental Protection Agency. ARB’s mission is to promote and protect public health, welfare, and ecological resources through effective reduction of air pollutants while recognizing and considering effects on the economy. The ARB oversees all air pollution control efforts in California to attain and maintain health based air quality standards.

The energy challenge facing California is real. Every Californian needs to take immediate action to reduce energy consumption. For a list of sample ways you can reduce demand and cut your energy costs, see our Web-site: <http://www.arb.ca.gov>.

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